

David Abrahams

① a)  $a^{2^n}$

if  $p = 1$ : chose string  $aaaa$   
 ~~$x = ''$~~   $x = ''$ ,  $y = 'a'$ ,  $z = 'aaa'$   
 $xyz$  not in language  
if  $p = 2$ : chose string  $aaaa$   
 $x = ''$ ,  $y = 'aa'$ ,  $z = 'aa'$   
 $xyz$  not in language  
 $x = 'a'$ ,  $y = 'a'$ ,  $z = 'aa'$   
 $xyz$  not in language, etc.

No matter what  $p$  is, if you can repeat  $y = 'a'$  a certain  $p$  # of times so length  $\neq 2^n$

b) Regular:  $(0[01]^*0) / (1[01]^*1)$

c) Irregular, ~~because~~ assume  $p = 4$ :

0000110000  
 $y = 0^n$

by repeatedly the 0s at the beginning,  
you break the rule.

2) 10 is regular

$(a(aaa)^*(b/bbb)^*aa(aaa)^*) \cup (aaa)^*(bbb)^*(aaa)^* \cup$   
etc.

4  
 I gave it  $a^20b^{10}a^{30}$ , computer chose an  
 $a$ , I did  $a^{30}b^{10}a^{20}$  which is  
 not in language

5  
 I gave  $a^{13}$ , substring first 9 characters,  
 pumped an  $a$ , got  $a^{14}$ , not in language

